

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Status of Claims:

Claims 1 and 7 are currently being amended.

No claims are currently being added or canceled.

This amendment and reply amends claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claims remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-16 are pending in this application.

Claim Rejections – 35 U.S.C. § 112, 1st Paragraph::

In the Office Action, claims 10, 13, and 15-16 were rejected under 35 U.S.C. § 112, 1st paragraph, as failing to comply with the written description requirement, for the reasons set forth on pages 3 and 4 of the Office Action. This rejection is respectfully traversed for the reasons given below.

Claim 10 (and claim 13, which recites similar features) recites that when the inspection window has been corrected using the image picked up from the model of the board having no parts mounted thereon, the image input means images a second board having parts mounted thereon, wherein, based on the imaging of the second model of the board, the registration means only registers the inspection data file after making a determination that the corrected inspection data is proper. See, for example, Figure 6 of the drawings, step ST7 in particular. In step ST7, a bare board (that is, a board with no parts mounted thereon) is delivered, and also a parts-mounted reference board is also delivered. This fully supports the features prior to the “wherein” clause of claims 10 and 13. Support for the “wherein” clause of claims 10 and 13 can be found in steps ST9, ST10, ST11, ST12 and ST13 in Figure 6 of the drawings, and in the description of those steps in the specification. . See also page 31, last line to page 32, line 5 of the specification (“reference board is for testing whether the inspection data produced by the aforementioned process is proper or not”).

With respect to claims 15 and 16, those claims recite that the inspection data file including the corrected set data is automatically corrected when the image area corresponds to each land on the board to be inspected has been either increased or decreased with respect to the read inspection data. Support for these claims can be found on page 38, lines 5-8 of the specification, which states that “in the case where a board design rule is changed or a new board design rule is introduced whereby the land size of a part is changed, the inspection data produced using the existing parts library can be automatically corrected.” This provides clear support for claims 15 and 16 (whereby ‘changed’ means ‘increased or decreased’).

Accordingly, claims 10, 13, 15 and 16 have full written description support in the specification, and thus those claims fully comply with 35 U.S.C. § 112, 1st paragraph.

Claim Rejections – Prior Art:

In the Office Action, claims 1-8, 10, 11 and 13-16 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,278,797 to Nagasaki et al.; and claims 9 and 12 were rejected under 35 U.S.C. § 103(a) as unpatentable over Nagasaki et al. These rejections are traversed for at least the reasons given below.

The present invention is directed to providing a board inspection apparatus or method which is capable of automatically correcting/adjusting the settings of inspection windows when the position or size of lands on the inspection target board has been changed due to changes in design rules for designing the board, so that an inspection window is appropriately adapted for inspection of a board.

According to the present invention, the set data for setting the inspection windows is automatically corrected by using an image taken from a model board for a board to be inspected. More specifically, inspection windows, which are included in inspection data pre-registered in a parts library (produced using an image of a board designed based on a prescribed, predetermined design rule), are read out from a parts library and assigned to an inspection target board. Then, when a design rule has been changed and the read inspection windows fail to correspond to size or position of the lands on the board, the read inspection windows are automatically corrected based on the image area of the lands on the model board so that the inspection windows, after adjustment, appropriately correspond to the parts on the target board. Such automatic correction of the set data for the inspection windows greatly contributes to time savings and labor savings in a board inspection process or system.

More specifically, each of the presently pending independent claims has been amended to recite that the set data for setting an inspection window included in the read inspection data is automatically corrected, when the inspection window is displaced with respect to the image area corresponding to each land, so that the inspection window is adapted for inspection of the board.

Turning now to the cited art of record, Nagasaki et al. is directed to an apparatus for inspecting a land-attached circuit board. Nagasaki et al. discloses that the inspection apparatus is capable of detecting the information on a land existing region, and the size, area, and formed position of the land. Nagasaki's inspection apparatus is capable of inspecting height levels of the lands by two-dimensional scanning of an inspection beam, as described in the Abstract and column 12, lines 10-15 of Nagasaki et al. However, Nagasaki et al. does not disclose or suggest the above-mentioned features of the present invention as discussed above, and Nagasaki et al. does not disclose or suggest the correcting of inspection windows so as to appropriately correspond to the parts on a board to be inspected.

With respect to the features of correcting inspection windows in independent claim 1, the Office Action cites column 6, lines 50-57, column 3, lines 55-61, column 7, lines 1-12, column 4, lines 4-41, column 21, lines 4-25 and Figures 12A and 12B of Nagasaki et al. Applicants respectfully disagree.

Namely, column 6, lines 50-55 of Nagasaki et al. describes position tolerance defining window setting means for setting tolerance defining windows for defining a tolerance of a position where each land is formed. However, the tolerance of a land does not correspond to a changing of a design rule, but rather it corresponds to allowances to be made for formation of a land during a normal manufacturing process of a land. Column 3, lines 55-61 of Nagasaki et al. describes that land size information is prepared to reflect an area and/or other dimension of each land on the basis of an area and/or other dimensions of corresponding land existing regions. Column 7, lines 1-12 of Nagasaki et al. describes that an inspection beam is provided onto an inspection surface while a circuit board is held in place, whereby height level calculating means calculates a height level of each land above a reference height level. Column 4, lines 4-41 of Nagasaki et al. describes characteristics of a land center calculating means that calculates a point of intersection of diagonal lines of a quadrilateral region that circumscribes land existing regions, whereby each land existing region is fixed by means of an image which has pixels disposed on a pixel plane. Column 21, lines 4-25 of Nagasaki et

al. describes that a correction data group storing section stores a deviated amount based on an inclination angle of each surface of a polygon mirror, in order to obtain corrected coordinate values and height levels of the lands, and is not at all concerned with correcting any inspection windows. Figures 12A and 12B of Nagasaki et al. show the content of a receive data storing RA and the content of a corrected data memory section, whereby that data includes height data, brightness data, and positional data.

Since Nagasaki does not disclose, teach or suggest automatically correcting set data for setting an inspection window included in the read inspection data, when the inspection window is displaced with respect to the image area corresponding to each land, so that the inspection window is adapted for inspection of the board, presently pending independent claims 1 and 7 patentably distinguish over that reference.

Still further, with respect to dependent claims 11-14, the Office Action asserts that column 4, lines 21-41 and column 23, lines 43-67 of Nagasaki et al. discloses or suggests these features, but Applicants respectfully disagree. Namely, claims 11 and 12 recite that the inspection window is corrected using the image picked up from the model of the board on which no parts have been mounted. Column 4, lines 21-41 of Nagasaki et al. describes that an image of each land existing region and a master image are formed by a combination of pixels in output states, whereby those images are matched with high accuracy, so as to fix the position of the land existing regions. There is no disclosure or suggestion in this portion of Nagasaki et al. that the master image corresponds to a model of a board on which no parts have been mounted. Column 23, lines 43-67 of Nagasaki et al. describes that an image obtained from pixel data can be used as an image indicating a land existing region and a master image, whereby a standard picked-up image can be used as a master image. Clearly, the master image described in this portion of Nagasaki et al. cannot correspond to a model of a board on which no parts have been mounted.

Accordingly, dependent claims 11 and 12, as well as claims 13 and 14 which recite similar features (albeit in a slightly different way than how they are recited in claims 11 and 12) are patentable for these additional reasons, beyond the reasons given above for their respective base claim.

Furthermore, with respect to dependent claims 15 and 16, those claims recite that the inspection data file including the corrected set data is automatically corrected when the image

area corresponds to each land on the board to be inspected has been either increased or decreased with respect to the read inspection data. The Office Action incorrectly asserts that column 23, lines 43-67 of Nagasaki et al. discloses or suggests these features. Rather, column 23, lines 43-67 of Nagasaki et al. describes that an image corresponding to a plurality of pixels can be set to produce an intermediate output (e.g., gray scale or color image), which can be used as an image indicating a land existing region and a master image. This portion of Nagasaki et al. also describes that the position where the master image becomes minimum is found, and the coordinates of a center of a land is calculated. With all due respect, this process for computing the center of a land in the system of Nagasaki et al. has nothing at all to do with increasing or decreasing an image area corresponding to each land on a board to be inspected (with respect to read inspection data).

Accordingly, dependent claims 15 and 16 are patentable for these additional reasons, beyond the reasons given above for their respective base claim.

Conclusion:

Since all of the issues raised in the Office Action have been addressed in this Amendment and Reply, Applicants believe that the present application is now in condition for allowance, and an early indication of allowance is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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